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Grumman Proposing C-2A As EA-3 Replacement

Aircraft Systems will propose a modified C-2A Greyhound in a competition to replace the Navy's aging fleet of EA-3 electronic reconnaissance aircraft.

Built by Douglas, the EA-3 has been flying since the 1950s. The Navy wants to buy 24 new "EX" aircraft to be delivered between 1990 and 1991. Such a contract could mean one-half to three-quarters of a billion dollars in business for Grumman.

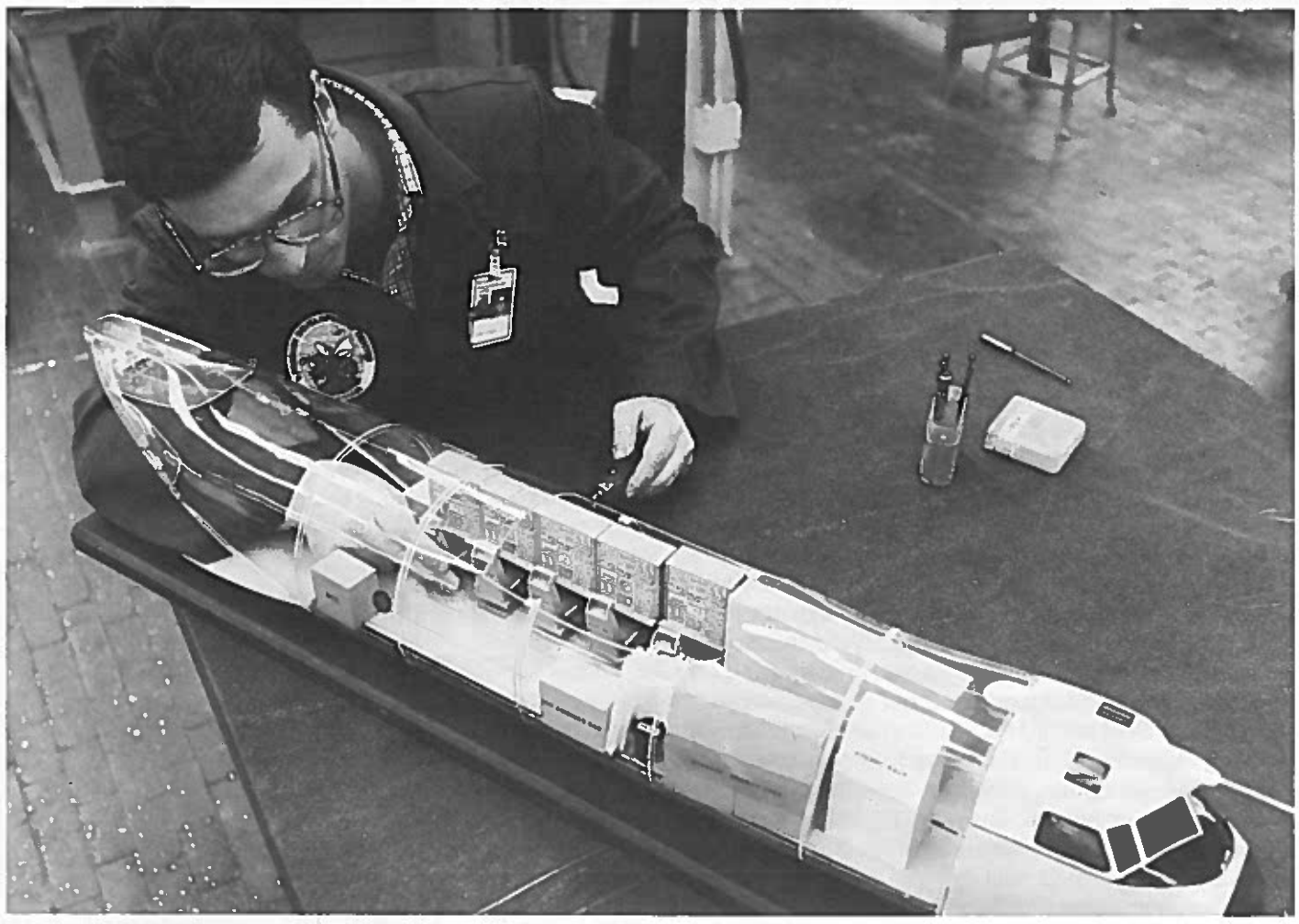
Grumman delivered its letter of interest to the Naval Air Systems Command on Friday, January 23. The formal request for proposal will be issued in several weeks and an award announcement should be made around midyear. The modified version of the Greyhound has been dubbed the EC-2.

"Lockheed is the only other obvious bidder for this job," says John Stark, C-2A Program deputy director of Development and head of the proposal effort. "The plane has to be carrier-based, and the C-2 and Lockheed's S-3 are the only two that can be readily modified for the mission."

"Affordability is the key to winning the EX," says Harvey Fromer, C-2A program vice president. "We've got to find a way to modify the C-2A to give it the desired operational capability, while living within the Navy's budget and offering it at a lower price than the Lockheed S-3 version. That's not an easy task, considering the complexity of the modification program."

The cargo bay of the EC-2 would be filled with updated, off-the-shelf intelligence gathering equipment and data links for transmitting real-time information to the carrier battle group commander. The Grumman version of the EX would have sufficient space for a complement of five operators, according to Stark.

Lockheed is expected to bid a modified version of its S-3 Anti-Submarine Warfare platform. However, the Lockheed production line has been closed since 1979. By contrast, if Grumman were to win the award the C-2A production line would shift into EC-2 production. The Navy purchased 39 C-2A carrier on-board delivery aircraft under a multiyear reprocurement contract signed in 1983. To this point, 17 of the 39 have been delivered. They are operating out of Cubi Point, the Philippines, and Sigonella, Italy.■



A New Cargo For Greyhound? *John Staudt, a junior modelmaker in the Aircraft Systems model shop in Building 5 in Bethpage, has an inside look at what might be the EC-2. The model shows the five operators' consoles in this electronic reconnaissance version of the carrier on-board delivery C-2A. Model makers used parts from other models to build this one. The fuselage, for example, was a pallet-loading model. It had a little crank in the nose to show how cargo is drawn up into the bay. (Photo by Rich Breunig)*

Pakistan Picks Grumman For Aircraft Study

Under contract for the government of Pakistan, Grumman will study the technical feasibility of integrating U.S. engines and avionics into Chinese-built fighters.

The improved aircraft would be a cost-effective replacement for aircraft currently in the Pakistan Air Force inventory. Multi-mode radar, new cockpit displays and navigation systems are among the features being studied. Pakistan wants to hold the flyaway cost to well below that of today's Western-built fighters.

"This venture gives Grumman the opportunity to demonstrate to the world market a new facet of our expertise as aircraft systems integrators," says Chairman Jack Bierwirth.

Grumman was one of five major companies that bid on the request for proposals issued by Pakistan. Work on the study begins in March.

The results of the study will not commit Pakistan to purchase Grumman's ideas on how to update the fighter, which goes by the name "Sabre II." Pakistan will compare the cost and capabilities of Saber II to other available fighters.

International Meeting. *Grumman International President Rolf Larson (L) discusses the fighter study with Air Vice Marshall Hakim Ullah of Pakistan. (Photo by Marie Trimborn)*

"However, the cost of other modern aircraft with all these capabilities is significantly greater," says Grumman International President Rolf Larson. "In addition, Pakistan would pick up manufacturing and technical capabilities they do not have now, because some portion of the work would be performed there."

Grumman will be working with Chengdu Aircraft Corporation of China throughout the study. Prime candidates for the engine replacement are General Electric's F404/100 and F404/400 and Pratt and Whitney's PW1120 and PW1216. Whatever Grumman finally recommends is subject to the approval of the U.S. government.

Pakistan is also considering the purchase of E-2C Hawkeye airborne early warning aircraft. Pakistan is considering several aircraft for this role, including the E-3 AWACS, the British Nimrod and airborne early warning variants of the Lockheed P-3 and C-130, as well as the Hawkeye.■

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Aerostructures To Design, Build GE Transcowls

General Electric recently selected Grumman Aerostructures to design and build advanced composite transcowls for its CF6-80C2 engine. This powerplant is used on all wide-bodied jets built by Boeing and Airbus.

The transcowl is the moving part of a nacelle that acts as a thrust reverser. It moves back and forth on tracks and turns the engine fan air through cascades (louvers) that provide reverse thrust.

"Our new design features lightweight composite parts with a minimum number of detail parts," says Aerostructures President Tom McGrath. "Over 70 percent of the transcowl is made of composites."

The original purchase order of 210 units is worth $30 million. Over 1,000 units are expected to be required between 1988 and 1995. The transcowl bonded assemblies will be build in Milledgeville, Georgia, while final assembly will take place in Stuart, Florida.

Systems Support Rings Up New Maintenance Contracts

WOODBURY, New York — Users of Fujitsu and Mitel private automatic branch exchange (PABX) phone systems are now dialing Grumman for service calls.

That's the result of a recent agreement between Grumman Systems Support and American Interconnect Systems, a PABX vendor headquartered in Hauppauge, Long Island. Grumman will provide installation, maintenance, and support for the Fujitsu Focus and Mitel SX series PABXs sold by American Interconnect. The agreement covers customers in New York City and Long Island.

Grumman Systems Support specializes in 'round-the-clock computer maintenance, and has grown fast to become one of the nation's largest independent service organizations. Its venture into telecommunications support is prompted by an industry trend toward combining telecommunications systems with computers.

"Integrated voice and data systems are becoming predominant," says Al Andrus, president of Grumman Systems Support. "That creates a need for integrated service capabilities. We have been moving in that direction for several years."

"Today, the telephone switch is often the hub for all communications," says Larry Gugliano, telecommunications manager for Systems Support. "Tied to it are mainframes, PCs, local area networks, as well as telephone systems. We'll be able to give them one-source maintenance."

This type of service is not entirely new to Systems Support, however — for several years, its Telecommunications department has been servicing equipment owned by Grumman.

The service agreement covers moves, additions, and changes for PABX equipment — including the main switches, operators' consoles, individual phones, and other components. A number of Grumman technicians have been factory trained and certified by both Fujitsu and Mitel to service their PABX systems.

Currently, there are 16 customers covered. Among them are Noel Industries, Jewish Education Services, Rickel Home Centers, and Rockaway Metal.

All these customers use the Mitel SX, which can encompass 20 to 200 phone stations. The brand-new Fujitsu Focus is for users requiring 50 to 2,000 stations. Depending on the outcome of proposals, American Interconnect and Grumman may soon install five new Focus systems on Long Island.■

Next Lecture: March 2

Dr. Russell Messier of Penn State will give the next Leroy Grumman lecture on March 2. The topic: diamond coatings.

The lecture will be held in the Grumman Headquarters auditorium, concourse level, at 4:30 p.m.

Dr. Messier is a member of Penn State's Materials Research Staff and is on the faculty in its Department of Engineering Science and Mechanics.

Coating objects with thin films of synthetic diamond may one day have a huge impact in electronics, optics, machine tools, chemical processing, and military technology. Such coatings could improve a wide range of devices — from rocket engines to razor blades.

This is the third in a series of lectures to inform Grumman's scientists and engineers. The series is named in honor of company founder Leroy Grumman and aims to further his commitment to technical excellence.

All Grumanites are invited, but space is limited. To make a reservation, call Susan Boccasini at Ext. (111) 63396 or 53766 (516-346-3396 or 575-3766).

Data Systems To Install Supercomputer In Huntsville

Grumman Data Systems Division has received a $10 million follow-on contract to provide a replacement computer system for the Strategic Defense Command, Huntsville, Alabama.

The computer is for the command's simulation center, and the work is being performed by Grumman's Huntsville office. The contract spans six months. This latest phase calls for the installation of a high-speed back-end processing system based on a Cray supercomputer.

The first phase began last March, when Grumman received a $9 million, six-month contract to install a general purpose engineering and scientific computer, communications system, and graphics system. That has now been completed.

The Strategic Defense Command's simulation center provides computing capabilities for the scientists and engineers studying ballistic missile defense technology. The simulation center performs feasibility studies, evaluates risks, integrates systems and subsystems, and helps in decision making.

The Strategic Defense Command isn't the first supercomputer customer Grumman Data Systems has had in the high-tech Huntsville area. Nearby, Data Systems installed the Engineering Analysis and Data System for NASA's Marshall Space Flight Center. An hour or so away, Grumman put together the Test Integration System for the Arnold Engineering Development Center in Tullahoma, Tennessee. It is now involved in a program to upgrade other computer systems at the Center.■

They Do It All. *If it's electronic and has to do with an E-2C or C-2A, it goes here — the Avionics Test and Integration Lab in Building 4 in Bethpage — before it goes into a plane. Ron Wilson (R), a navigation systems leadperson, and technician Mike Sall calibrate and adjust production units of CAINS, the Hawkeye's Carrier On-board Inertial Navigation System. (Photo by Bob Settles)*

Future Manufacturing Engineers Can Apply For Grumman Scholarship

If you want to get ahead in the technical world, you might consider the Grumman Manufacturing Engineering/Technology Scholarship.

The program is open to all Grummanites, as well as Long Island residents. To be eligible, you must have an associate's degree in mechanical engineering/technology, or two years of engineering school.

Manufacturing scholars receive annual awards, which are applied toward tuition, fees and expenses for their four-year degrees. It can be used for any four-year accredited program in manufacturing engineering or technology.

Fourteen scholars are currently finishing their studies at schools throughout the U.S. In addition, 18 graduates now work at Grumman.

Jim Logan, an '85 grad, is a manufacturing engineer in Optical Tooling and Metrology, Building 2, Bethpage. He received his bachelor of science in manufacturing engineering technology from Weber State College, Ogden, Utah.

Logan's course work covered a broad range of industrial technology subjects — including computer aided design and manufacturing (CAD/CAM), tool design, machining, and materials science. Since he was a transfer student — from SUNY-Farmingdale — his course load was heavy. But it was worth it.

"In this field, a four year degree is really a necessity," says Logan. "I see a lot of guys with two-year degrees, who are going to school at night for a bachelors. I'm glad I didn't have to do that."

Deadline for applications is March 15. For more information, contact Ron Blau, Ext. (111) 57570.■

An Interview With Aerostructures President Tom McGrath

'Five years from now, Aerostructures could very well have an entirely different mix of programs than today.'

As part of a new series of interviews with Grumman division presidents, *Grumman World* recently interviewed Tom McGrath, president of Aerostructures. This division is headquartered in Melville, L.I.

Grumman World: *Has being identified as a Grumman division helped business?*

McGrath: Definitely. It shows that Grumman is firmly in the subcontractor business. That's very important to our customers. They always fear that our corporate resources won't be available for them at a later date. They might say, "You need our subcontract business now, Tom, but as soon as volume picks up on the F-14 or A-6 you're going to forget about us."

That fear is clearly unwarranted today. Back in 1979, Grumman consolidated all its subcontract work under one organization to insure that our customers would receive the utmost attention. Forming the Aerostructures Division took that initiative one step farther.

GW: *How did Aerostructures fare in 1986?*
TM: Our sales were over $125 million. About 57 percent of that work was on commercial customers; the remainder on U.S. and foreign militaries.

GW: *How much subcontract work is there in today's marketplace?*
TM: A significant portion of today's subcontract market opportunities involve military aircraft assemblies and aircraft conversion kits for foreign governments. Capturing a share of these programs is a prime objective.

In this division, our goal is to win contracts by the early '90s that will yield sales of $400-$500 million per year. The company must decide where to invest its capital. Subcontracts — on both the military and commercial side of the house — do require investments and risk sharing.

So we must be even more selective about the programs we go after. On an average, we usually concentrate on winning two or three significant new programs a year. I'm pleased to say that all the major ones we've pursued in 1986 we've won.

GW: *Which ones were they?*
TM: General Electric selected Grumman to design and build an all-composite transcowl for its CF6-80C2 engine. The contract award for 210 units was recently signed and is initially worth $40 million. Over 1,000 units are expected to be required between 1987 and 1995; the program will be worth over $160 million to Grumman.

In addition, we've won a contract to produce F-15 rudder spares for the Air Force at Warner-Robins in Georgia, and a contract for the full-scale development effort on a composite raceway for the Aerojet Corporation's small ICBMs.

We are currently negotiating with McDonnell Douglas to design and build composite control surfaces for the new C-17 military transport. This plane will replace the C-130s and C-141s in the 1990s. Worth over $30 million initially, the anticipated follow-on production program for 210 aircraft is valued at $300 million.

GW: *What are the risks involved in subcontracts?*
TM: First, there is money needed for research and development and for putting out a proposal. Today, an average proposal could be volumes long, require extensive design work, mock-ups, video displays, etc. — in short, a significant investment just to bid.

Most customers, including the Department of Defense, want suppliers to amortize up front non-recurring costs and share in the market risks of the program. We must forecast the number of units the customer will be able to sell in order to fully recover our investment.

If you can accept a contract with these inherent risks, you could ultimately have a substantial program with quantities that significantly exceed the initial order.

GW: *Does Aerostructures pursue many contracts just to gain experience and build a reputation?*
TM: Yes. Over the years, we have signed several contracts on a break-even basis because they offered an excellent opportunity to increase the Aircraft Systems Division's knowledge of certain technologies — both in engineering and manufacturing. Later on, these contracts might well turn into long-running, profitable production programs.

We've gained a lot of experience in composites in recent years. A prime example is the Boeing 757

'We've gained a lot of experience in composites in recent years'

wing spoiler program, which began in 1980. The spoilers, which are made of graphite epoxy material, represent an opportunity to learn how to handle high-rate production of composite parts. There are 12 spoilers in each shipset. We designed and built the tooling and test articles, and are now in the middle of producing 200 shipsets of spoilers.

Another example is the Lavi wing program for Israel Aircraft Industries. This program has offered us the opportunity to design and build the company's first fuel-carrying composite wing. A great majority of that design work was performed by engineers working solely on the GEMS scopes.

On the V-22 Osprey subcontract, we are gaining valuable experience in designing and building large, lightly-loaded composite structures. Grumman didn't arrive overnight in the case of V-22. It took a long time and lots of R&D work to get to the point where we could even bid on the V-22.

GW: *Grumman and Kongsberg Vaapenfabrikk (KV) of Norway have teamed to market the KV Penguin missile. Where does this program stand?*
TM: Aerostructures is providing folding wing design, wing components, and technical support to KV in order to install the missile on Navy's LAMPS III helicopter for flight test. The Navy plans to initially buy approximately 200 missiles for the LAMPS III. Grumman would build the wing components and assemble the missiles. Production will start in 1989.

GW: *Is the 767 program meeting your expectations?*
TM: That program has been a disappointment in terms of rate. Orders for Boeing's 767 airliner were slow in the beginning and are just now picking up. However, quantities are going up; we had been building only two a month, that's now up to three-and-a-half and going up to five by the end of '87.

The original order of 200 shipsets will be completed in August 1988. Boeing recently expanded its market by introducing new stretch versions for the 767 jet airliner, so we expect them to carry the production line through the 1990s.

GW: *How is the nacelle and thrust reversers program for Gulfstream IV and Fokker 100 progressing?*
TM: There is a strong possibility that both companies will double their orders soon. As part of the original contract, Grumman funded the engineering design, tooling, building and testing of the assemblies. We had planned to recover this investment by amortizing the cost into the selling price of the production nacelles and thrust reversers. Both customers made significant changes to their nacelles, thereby increasing the up-front costs. We reached a new financial agreement at the end of last year which is fair to all parties.

We are now in the process of setting up the production line at Stuart Operations and working out the glitches. The production run is quite demanding — up to eight shipsets a month by this summer. As a result, we've got a lot of catching up to do. Unfortunately, the schedule hasn't slipped that much to accommodate all the changes. As usual in this business, you give at one end and nothing moves at the other.

GW: *At what stage is Grumman's work on the Israeli LAVI wing?*
TM: Many changes have been made to the original wing design. The redesigned wing is due in Israel in the May-June timeframe.

On December 31, the first Lavi flew with our interim wing and it's meeting all its flight requirements. The Israelis wouldn't open up the flight envelope until they get the redesigned wing on their airplane.

As for production of the Lavi wing, the political situation is still unclear. If the aircraft production program does go forward, Grumman would like to build all the wings. The Grumman-designed vertical tail would eventually be built in Israel, while we would build the wings in Milledgeville, Georgia.

GW: *Grumman has a development contract for the V-22 empennage section. Do you see a long life for the Osprey V-22?*
TM: Definitely. We deliver the first development article later this spring. Delivery of other

'In the subcontracts business, it's up and down all the time'

development units will be completed by January 1988. Initial fabrication of detail composite parts began in September at Milledgeville; all sub and final assembly efforts will take place in Stuart Operations in Florida.

Following this full-scale development is a DoD multi-service initial procurement of 913 production aircraft. While no contract is guaranteed, we believe we're in a prime position for a production contract. This contract, which will be awarded in 1989, would be worth about $500 million.

GW: *How many people work for Aerostructures?*
TM: About 250 people are permanently assigned to this division and we use the services of other divisions — about 1,300 or so Grummanites work on Aerostructures programs around the company.

In the subcontracts business, it's up and down all the time. Many programs don't last more than two or three years. Five years from now, Aerostructures could very well have an entirely different mix of programs than today. International events, economic and political factors can change the subcontract business dramatically in a very short time span. It's the dynamic nature of the business we're in — that's what makes it so challenging, exciting and rewarding.■

The A-6F Cockpit Will Blow The Socks Off Intruder Crews

When all other attack aircraft are grounded because of weather or poor visibility, the Grumman Intruders fly, find their targets and strike with devastating accuracy.

It's been the Intruder's hallmark since its introduction in the early '60s. Now under development, the A-6F — the fifth generation of Intruders — will raise the standards for all-weather attack aircraft even higher. With its new advanced radar system, assortment of avionic updates and more powerful engines, the A-6F will provide the U.S. Navy with a premier all-weather attack plane well into the 1990s.

As in past years when new technology was incorporated into the Intruder, more and more information will be generated. To help ease the crew's workload, new cockpit displays are on tap for the A-6F.

"It's like no cockpit I've ever been in," says former Navy pilot Scott Jameson, who is a member of the Grumman A-6F flight test team at Calverton.

'If one display fails, what was on the screen can be moved to an available screen'

Most of the information the A-6F crew needs will be shown on a head-up display and five multifunction displays; today's Intruders feature eight dedicated, head-down cockpit displays or instruments.

On the pilot's side of the cockpit, there will be two multifunction displays. The vertical situation display will provide attitude (artificial horizon), airspeed and altitude information, while the horizontal situation display will feature a digital color map as well as compass and heading data. The bombardier/navigator can also call up this data on one of his display screens.

"The crew will be able to see land masses, contours, cities, and rivers in specific colors," says Ron Dahl, A-6F crew systems/equipment integration group leader in Melville, Long Island. "Flight paths, checkpoints, enemy threats and the target will be superimposed on the map."

During most of the flight, the pilot will also use the head-up display. "While this display physically replaces the A-6E's optical gun site, it is infinitely more useful," says Dahl.

"It's similar to having fuel gauge and speedometer information displayed on the windshield of your car," says Dahl. "Information projected within the view of the windscreen allows the pilot to monitor such things as attitude, altitude and airspeed without taking his eyes off the windscreen."

To a large extent, the head-up display will provide the same information to the pilot as the vertical situation display on the cockpit panel. "The head-up display will be more practical for visual daytime landing and air combat maneuvers when the pilot can see what's out there," says Jameson. "On the other hand, it'll be more logical to use the vertical situation display at night or when there is poor visibility."

'It's very important to have system redundancy built into a plane'

The bombardier/navigator will have three displays at his disposal. A stores management system display will supply up-to-the-second inventory and status of the Intruder's weapons payload. A radar display will provide target data, while the forward-looking infrared display will present a high resolution picture of the terrain.

As a result, A-6F crew members will be able to better coordinate their tasks. The new A-6F radar will add air-to-air ranging and detection and maintain the Intruder's air-to-surface target recognition, tracking and designation.

"In a typical battlefield scenario, the target is located using the radar, then the bombardier/navigator uses the infrared system to show the target at close range for the actual attack," says Jameson.

Once the target is locked onto, the bombardier/navigator will switch the computer to the attack mode. "On the pilot's side of the cockpit, the vertical situation display will automatically show the plane's attack steering commands as it gets closer to the target," adds Jameson.

After the pilot lines up the plane over the target, the computer will issue a bomb release command. "All this time, the pilot will keep the trigger on his control stick depressed," says Jameson. "If he releases the trigger at any time, the attack will cease. The attack is over when the word 'complete' is displayed on the stores management system screen."

'It's similar to having fuel gauge and speedometer information displayed on the windshield of your car'

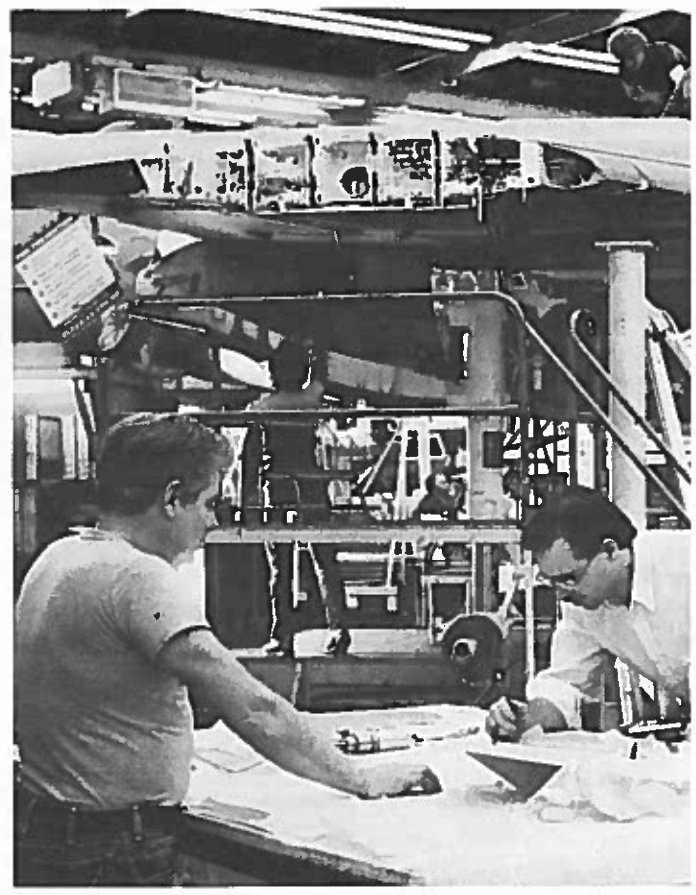
A host of "ilities" are being built into the new A-6F cockpit, such as flexibility, commonality and survivability.

"We've built flexibility into the A-6F cockpit," says Dahl. "If one display fails, what was on the screen can be moved to an available screen.

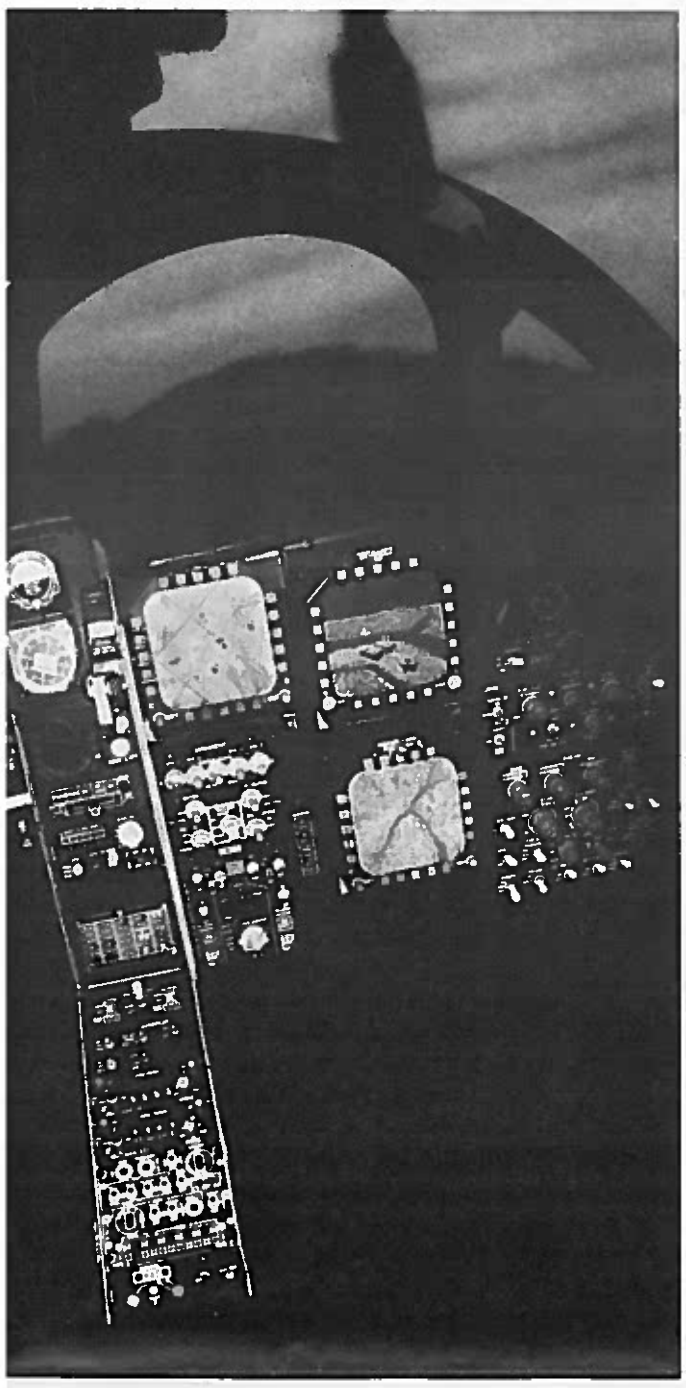
"It is very important to have system redundancy built into a plane," continues Dahl. "If something fails, the mission can still be completed. If this happened on an A-6E, the crew would probably have to go back to base without completing the mission."

The multifunction nature of the displays will also let the pilot call up one of the bombardier/navigator's screens and vice versa. "The pilot may want a radar format shown on one of his displays, while the bombardier/navigator may want the pilot's vertical

Futuristic Cockpit. *In the new A-6F cockpit, most of the infc and five multifunction displays. The multifunction nature of th dier/navigator to call up data from each other's displays. Du display located up near the windshield. During this nighttime vertical and stores management systems displays, while the bc and forward looking infrared system display.*



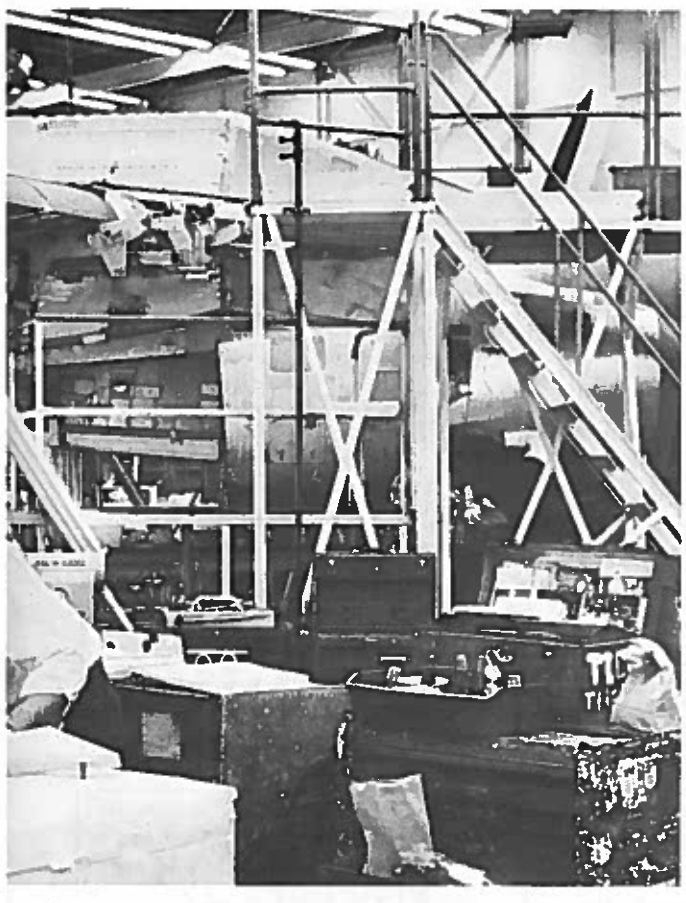
Take One. *Bill Slawata (L) and Bob Barreiro, final assembl development A-6F aircraft (shown in background), now being*



tion the crew needs will be shown on a head-up display splays will allow both the pilot and the bombar- most of the flight, the pilot will also use the head-up ıbat scenario depicted above, the pilot (R) monitors the ırdier/navigator is using the horizontal situation, radar

situation display on his side of the cockpit," says Jameson. "Or, both may want to look at the same thing. For example, the pilot may want to look at the radar while flying through the mountains at night. So, they'll both have it up on their screens."

Under an agreement with the Navy, the A-6F



chanics, look over blueprints for the first of five full scale t at Building 6 in Calverton. (Photo by Gerry Costello)

Empty For Now. *Scott Jameson (L), member of A-6F flight test team in Calverton, and Ron Dahl, A-6F crew systems/equipment integration group leader in Melville, check out A-6F prototype cockpit in Building 6, Calverton. (Photo by Gerry Costello)*

cockpit display units are similar to those found in the McDonnell Douglas F/A-18 and Grumman's next generation F-14D. An Air Crew Systems Advisory Panel, made up of Navy representatives, worked with Grummanites on the cockpit's development. A major goal was to achieve maximum commonality of equipment with other aircraft.

"Through commonality in aircraft, the Navy aims to cut costs," says Jameson. "On the carriers, only one maintenance shop will be needed to support common avionics from several different aircraft."

For example, the upgraded A-6F will use the

'Through commonality in aircraft, the Navy aims to cut costs'

Navy's standard AYK-14 tactical computers which are common in the F-14D and F/A-18. Other shared units include the stores management, navigation sensors, communications and automatic self-protect jamming systems which are also found on the Marines' AV-8B and F/A-18.

In addition, the A-6F cockpit will have a new electronic touchpad, called the digital entry keyboard indicator (DEKI). This touchpad will also be used in the F-14D. Packed with software, the powerful DEKI will "talk" to the plane's mission computer which transmits data to the displays and other systems. It'll replace a variety of individual control devices found on today's A-6E.

Several improvements are being made in the area of survivability. Though still primarily an attack aircraft, the Intruder will be able to fight back if jumped by enemy aircraft.

In addition to a new jamming system on board, the Intruder will normally carry two air-to-air missiles for defense on two new outer-wing pylon stations.

"In both the A-6E and the A-6F, the bombardier/navigator can preprogram what type of bombs or missiles he wants to use before the attack," says Dahl. "However, with the A-6F's stores management system, the bombardier/navigator can quickly alter that plan to better fit the situation. On the A-6E, it takes a lot more time to reprogram that new information."

Survivability is also enhanced by the pilot's head-up display installation. It will allow the pilot to see farther over the plane's nose — the angle of view is about eight degrees steeper than the 9.3 degrees in the A-6E. "He'll be able to better prepare for landing on an aircraft carrier," says Jameson. "With the A-6E optical gun site, he had to keep looking back and forth from his instruments to the windscreen."

With the head-up display, he will have all the required display information within his view while looking through the windshield.

A-6F cockpit simulation labs are still being built in Calverton. Testing of the overall operation is in progress and will be completed by 1988.■

Work Begins On Second A-6F At Calverton

The three main fuselage sections of E-167 — the second of five full scale development A-6F aircraft being built by Grumman — recently arrived at Calverton, L.I.

Meanwhile the first A-6F, E-166, now has its wings and vertical stabilizer attached.

New, more powerful General Electric 404 engines have also arrived at Calverton for the first A-6F.

Flight tests begin later this year; the other four planes will begin flying at two-month intervals thereafter.

Grumman plans to deliver the first of 150 production models of this next-generation Intruder in late 1989.

Nine Grummanites Receive Tech Awards From NASA

Nine Grummanites were recently honored by the National Aeronautics and Space Administration through its Technology Utilization program. This NASA program encourages the transfer of aerospace technology to non-aerospace uses. The Grummanites received $100, and technical papers about their inventions have appeared in the quarterly *NASA Tech Briefs*.

One invention — a sun shade for Shuttle payloads — has the potential to provide shade over swimming pools. It was invented by Silvio DeRespinis and John Mockovciak Jr. of Space Systems and Art Frank of Aircraft Systems.

Their sun shield protects sensitive Shuttle payloads from direct sunlight while its cargo bay doors are open. It can be as big as 15 x 60 feet, depending on the payload size.

"It works like a motorized window shade," says DeRespinis. "When shade is needed, a button is pushed and the hemisphere-shaped shield covers the cargo bay. If it were to be used over a swimming pool, the shield would have the same shape as the pool. It could also be used to shade greenhouses and boats."

Two inventions were conceived by Roy Olsen and Stan Coryell, who work in the Space Systems Division. They developed a controller for the anthropomorphic manipulator, a system of remote manipulator arms and tools. It would be housed in a shoulder harness which the astronaut would wear when servicing the Space Station or a satellite.

Olsen and Coryell also developed a mobile manipulator system, a robotic device used in Space Station maintenance. "The robot looks like a cart with two arms, a stabilizing leg, and a camera head," says Coryell. "An operator can control it from inside the Space Station. The robot repairs equipment on, around, and under the station structure."

Such robots may also prove useful on Earth — performing complicated tasks in hazardous situations.

Richard Brown and Fred Edelstein, also work in the Space Systems Division. They were honored for their Monogroove Cold Plate — part of the Space Station's heat transport system.

"Electronic equipment is mounted on a cold plate," says Brown. "Heat is generated by the equipment and is transferred into the cold plate and ammonia fluid. This keeps the equipment cool so it doesn't overheat. This invention is limited to space use."

Arthur Leifsen of Aircraft Systems created the Fastener Air Brush to paint Space Shuttle bolts and rivets. The hand-held, gun-like device is held against the Shuttle; a rubber seal on the end protects the structure and prevents primer from splashing onto other surfaces.

Until now, each fastener was hand brushed — which required a second coating. "Thousands of fasteners were painted by hand," says Leifsen. "This brush does the job in 70 percent less time. Commercially, the Fastener Air Brush can be used to paint fasteners or those hard-to-reach surfaces of any circular object."

Ronald Minlionica of Aircraft Systems developed a drilling tool and process for the Space Shuttle. It's used on the back side of the Shuttle's graphite/epoxy spars (a structure running along an airplane's wing, supporting its ribs).

"Most drilling tools cause damage to the spars' back side, which is inaccessible," Minlionica explains. "That makes it difficult to use some other type of material as a backup or to repair it. The geometry of the tool and the feeds and speeds of the tool's air motors are what maintain the hole quality."

Minlionica's invention is also being used to make the Israeli LAVI fighter's vertical and horizontal stabilizers and the V-22 Osprey's vertical and horizontal rudders.■

NASA Honors Five From Space Systems. *Alex Alexandrovich (center), president of Grumman Space Systems, presents NASA Tech Briefs awards to (L to R) Silvio DeRespinis, John Mockovciak Jr., Roy Olsen, Stan Coryell, and Richard Brown. Fred Edelstein was not available for photo session.*

Aircraft Systems Award Winners. *Renso Caporali (R), president of Grumman Aircraft Systems, presents NASA Tech Brief awards to (L to R) Arthur Leifsen, Art Frank and Ronald Minlionica.*

Obituaries

Patricia Cernigliaro of Information Systems Management, Woodbury, Data Systems Division, died December 14 at the age of 57. She had been with the company since 1969 and resided at 240 Feller Dr., Central Islip, N.Y.

Nicholas Markeloff of Vehicle Structural Analysis, Bethpage, Aircraft Systems Division, died January 8 at the age of 60. He had been with the company since 1958 and resided at 41-47 249th St., Little Neck, N.Y.

Ernest D. Marten of Research, Bethpage, Aircraft Systems Division, died January 6 at the age of 58. He had been with the company since 1951 and resided at 76 Horton Dr., Huntington Station, N.Y.

Jeffrey C. Miller of Electronic Test, Bethpage, Aircraft Systems Division, died January 5 at the age of 28. He had been with the company since 1985 and resided at 13 Linden St., Wheatley Heights, N.Y.

David O. Twelves of Product Development, Irvine, Space Systems Division, died January 13 at the age of 33. He had been with the company since 1986 and resided at 159 Pinestone St., Irvine, California.

New Appointments

The following Grummanites recently received new assignments.

Aircraft Systems

Technical Operations — Michael DiLeva, group leader, F-14 Electronic Countermeasures; Ernest Roberts, project leader, EA-6B Design; and Richard Chiafolo, group head, Systems Control.

February 28 Is Entry Deadline For 1987 Masters Fellowships

Start thinking now about your future in high-technology. The application deadline is February 28 for the 1987 Grumman Science and Engineering Masters Fellowship.

The two year program is open to Grummanites in Aircraft Systems, Aerostructures, Electronics Systems, and Space Systems. Fellows take nine credits per semester toward a masters in a technical field. To qualify, you must have a bachelor's degree in a discipline related to the analysis, design, or manufacturing of aerospace or electronics products, and have worked full-time since September, 1986.

During the program, fellows are considered full-time employees: they must put in at least 24 work hours a week during the academic year. During summer recess, they return to a 40-hour work week. Fellows receive a $1,200 tax-free stipend to defray study time they take off without pay.

Another benefit of the program is the rotational work assignment. Each fellow gets four six-month assignments — called tours — in different areas of Grumman. These are matched as closely as possible to career interests.

Grumman is billed directly by the schools for all tuition costs. In addition, fellows are reimbursed for all required books and fees.

A committee from the Grumman technical community will select and interview eligible applicants in early April, and all will be advised of their status by late April. Applications may be obtained from the Fellowship Office, A10-35, Ext. (111) 52682 (516-575-2682).■

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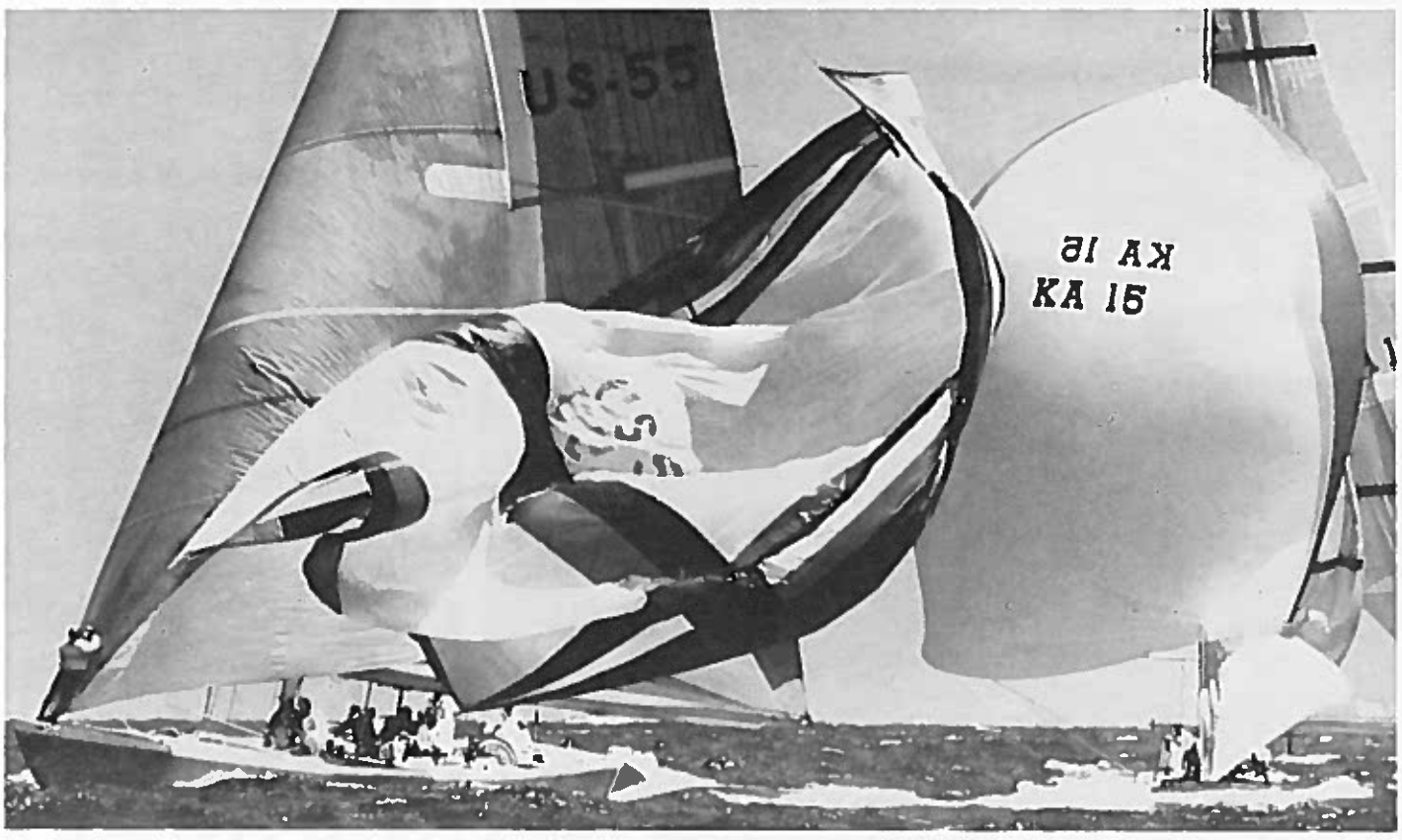

Homeward Bound. *The American yacht* Stars & Stripes *pops its spinnaker at the bottom mark as it leads Australian* Kookaburra III *during race two in The America's Cup. The American yacht went on to win the seven-race series, which was held recently off Freemantle, Western Australia. (AP/Wide World Photo)*

Grumman Designers Help Bring Home America's Cup

"I windsurf a lot," says Grummanite Bruce Rosen. "That's as close as this group comes to sailing."

Rosen and fellow landlubbers Charlie Boppe and Joe Laiosa helped design the *Stars & Stripes '87* — the yacht that last week won back the America's Cup from Australia.

Boppe is manager, Integrated Aircraft Technologies for Grumman Aircraft Systems, while Laiosa and Rosen are aerodynamics engineers. Laiosa was transferred to California, but until recently they all worked near each other in Bethpage's Building 35. They worked nights and weekends on the *Stars & Stripes* project for nearly two years. Yet there are no sailing calendars by their desks and no "I'd-Rather-Be-Sailing" license plate holders on their cars.

"When we lost the America's Cup in 1983, it was a slap in the face to American technology," Boppe says. "Working on this project has been a chance to demonstrate that America has the technological know-how — it's just a matter of putting it to work.

"Our work on this project has also benefitted Grumman," he adds. "It puts Grumman's high-tech skills in the national limelight."

Boppe had earlier worked with one of the Sail America Foundation's naval architects, Britton Chance. From Chance, the foundation learned of Grumman's computerized fluid flow modelling skills — and it invited Boppe and his colleagues to join the America's Cup design team.

As aerodynamicists, designing things that fly through water instead of air was a natural switch. "The same principles we work with in designing aircraft apply to boats," says Boppe. "The only new variables that must be taken into account are the surface of the water and the effects of waves."

The group's most noticeable contribution was the pair of tiny winglets on *Stars & Stripe's* keel. In fact, the Australians were the first to design a winged keel: for the 1983 cup winner *Australia III*. This was a radical departure back then, and one that many predicted would merit disqualification from the race. It didn't — the rest is sailing history.

Boppe reduced the winglets' surface area, making for less friction drag and improved lifting efficiency. He also helped design other enhancements including a more efficient keel shape and a more maneuverable rudder.

The Grumman designers used the computer both for designing the craft and running complicated test simulations. Under contract with Sail America, Grumman provided the company's equipment, and the Cray Corporation gave them a free hookup to a supercomputer in Minnesota.

Rosen developed a new method to automatically generate thousands of designs with subtle variations. He also wrote a program to accurately simulate the wave resistance a vessel would encounter on the ocean surface.

It's so sophisticated, in fact, the Navy is interested in it for designing surface ships and submarines. "The code is more complex than the Navy's," says Rosen. "The Navy uses its program to run simulations of destroyer designs. However, it can't duplicate side forces — only what the vessel encounters from ahead."

Winning Design. *Grummanites Joe Laiosa, Charlie Boppe and Bruce Rosen review designs of* Stars & Stripes *'87. For about two years, the trio worked after hours and weekends, helping to design the America's Cup winner. Laiosa was the only one of the three men who travelled to Freemantle, the Western Australia city where the race was held.*

The Grummanites' involvement on the project didn't stop when racing began in the fall of 1986. The craft underwent numerous alterations during the challenger-elimination series.

For instance, the Grummanites obtained data on the performance of *Kookaburra III*, the Aussies' entry, in the defender's series — the races among Australian craft in which *Kookaburra* was picked to defend the country's title. The Grummanites also obtained data from the subsequent challenger series — races in which other nations vied to challenge Australia.

By simulating the other yachts' performance in the finals, they refined the *Stars & Stripes'* design to ensure it came out ahead. In fact, the computer-designed winglets and rudder were among those changes.

Once the seven-race America's Cup competition begins, however, it's against the rules to alter the craft. At that point, it's entirely a matter of creative crew work. Stung by the '83 defeat, the Sail America Foundation assembled a top-notch crew — starting with Dennis Connor, the most experienced America's Cup skipper around.

Laiosa was the only Grummanite in the trio who made it to Freemantle, the Australian city that hosted the race. It's on the West Coast, near Perth. Laiosa was still in Australia at press time. Boppe and Rosen were content to watch the races on TV. They both subscribed to cable TV for the first time. Because of the time difference, it was aired from midnight to 3 or 3:30 a.m., Eastern Standard Time.

"Bruce has a VCR, so he taped it," says Boppe. "I don't own one, so I stayed up to watch. I wasn't sure how interesting it would be at first, but it was exciting. I wasn't able to take my eyes off it."

Boppe has fielded inquiries from sports and non-sports publications alike: journals as far afield as *Business Week* are interested in the design work that went into *Stars & Stripes '87*. The group also appears in a "Nova" documentary.

The group found merit in the other boats' designs. "For instance, *Kookaburra III* had a small computer atop its mast, giving the skipper the most beneficial sail shape for the wind conditions," says Rosen. "That helped him trim the sail."

Boppe saw a newfound competitive spirit among the American teams — and the companies that backed them. Before 1983, the U.S. had held the cup since the race was named The America's Cup in the mid-1800s.

"When you're always winning, you get conservative," he muses. "There's no need for you to take chances in design. That's what Australia did in '83 — and this time we beat them at their own game."■

Everybody Must File New W-4 Form In 1987

The new tax law requires that you submit a new W-4 form to Grumman before October 1, 1987.

If you do not file a new W-4 by the deadline, Grumman must withhold taxes from wages as if you are either single claiming one withholding allowance or married claiming two allowances — depending on whether you checked the "single" or "married" box on your most recent W-4 on file.

Although you must complete the new W-4 form before October 1, it is important that you complete it as soon as possible since you may be significantly affected by the new tax law. Your withholding — plus any estimated tax payments — should closely match your tax liability for the year. Failure to do so could create a situation where you would have a large tax bill, plus a penalty, at the end of the year.

The new 1987 W-4 form includes a worksheet which will help you determine the number of withholding allowances you should claim. The new forms are available at all Employee Services offices.

For more information, call the IRS Tax Forms/Publications toll-free number — 1-800-424-3676 — for free copies of the following booklets: "Tax Withholding and Estimated Tax" (Publication 505), "Highlights of 1986 Tax Changes (including the Tax Reform Act of 1986)" (Publication 553), and "Is My Withholding Correct?" (Publication 919).■

Let Us Know

We don't want to do all the talking.

We'd like to know what you think about the things you see in these pages, and what you see going on in the company. Serious comments, questions and complaints are welcomed, and will be answered by the people most qualified to respond.

We'll get back to you promptly with their replies. If the topic is of general interest, we'll print it.

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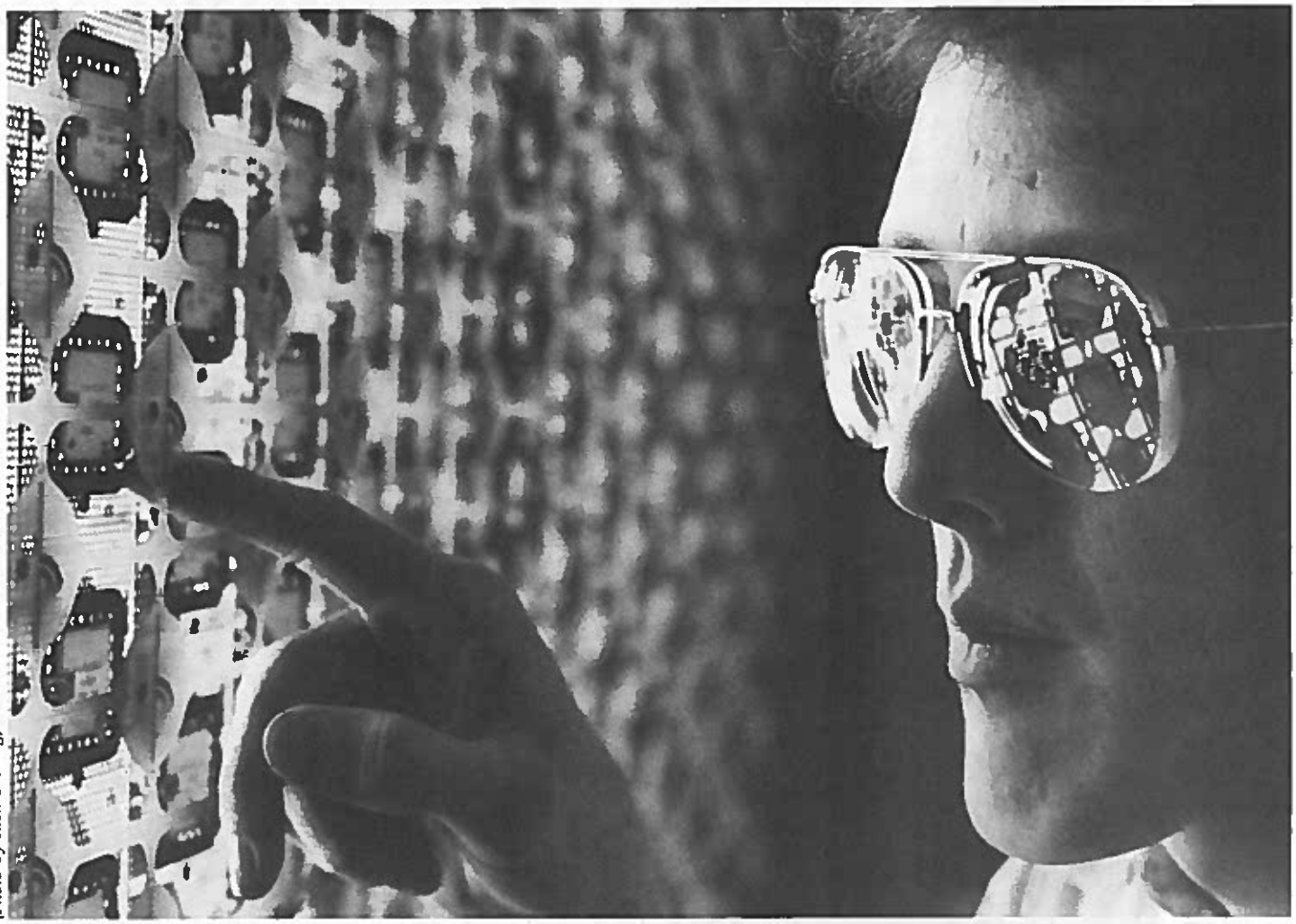

(Photo by Rich Breunig)

The Eyes Have It

In Bethpage's Engineering Development Center, radio frequency equipment engineer Tom Schmidt is looking at the lens of a space-based radar antenna.

A conventional radar dish focuses the reflected radar beams to a single point. In contrast, each of the elements in this antenna works with a segment of the returning radar signal. Transceiver modules modify the signal by means of self-contained electronics. The lens then focuses this modified signal onto the receivers in the radar-frequency feed behind the lens.

Actual antennas for space use will be much larger than this one, which the center's antenna lab uses for research and development. This version contains about 400 elements, while a space antenna could have 30,000, 40,000 or more.

For space use, such a design offers a variety of advantages. For one thing, it can "steer" itself electronically — which means it can rapidly adjust itself to pick up radar signals from different directions.

Such an antenna would be lightweight — it could be measured in ounces per given area, versus pounds for other designs. It would also be easily taken into orbit. The antenna would be rolled up like a rug, put in the launch vehicle, taken to space, unrolled and put to work.

Grumman has been working on space-based radar designs for about a decade. The technology will be applied in both Atmospheric and Strategic Defense Initiative programs.